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USSR Report

MACHINE TOOLS AND METALWORKING EQUIPMENT



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**USSR REPORT
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CONTENTS

INDUSTRY PLANNING AND ECONOMICS

CEMA Officials on New Developments in Machine Tool Trade (Mikhail Melkonyan; EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV, No 2, Feb 84).....	1
Update on Economic Experiment in Soviet Machine Tool Plants (V. Romanyuk; IVESTIYA, 9 Mar 84).....	14
Long-Range, Inter-Branche Planning of Automation Proposed (V.V. Gol'bert, V.G. Lisitsyn; MASHINOSTROITEL', No 12, Dec 83).....	19

AUTOMATED LINES AND AGGREGATED MACHINING SYSTEMS

Nevskiy Plant To Receive Millions for CAD/CAM (V. Gerasimov; PRAVDA, 24 Feb 84).....	26
---	----

ROBOTICS

Updated Terminological Distinctions Between Manipulators (Yu. M. Soluyanov, B.A. Komel'; MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA, No 12, 1983).....	28
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INDUSTRY PLANNING AND ECONOMICS

CEMA OFFICIALS ON NEW DEVELOPMENTS IN MACHINE TOOL TRADE

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 2,
Feb 84 pp 50-57

[Article by Mikhail Melkonyan, CEMA Secretariat: "A Sign of the Times"]

[Text] The Stankostroitel'nyy zavod imeni S. Ordzhonikidze Production Association is one of the largest machine building enterprises of the Soviet Union. It produces equipment for the automation of production processes, which is well known not only in the country, but also far beyond its borders.

As was noted during the visit to the enterprise by Comrade Yu. V. Andropov, the collective of many thousands of the enterprise is developing extensive ties with workers and specialists of many countries. It has established especially close relations with two related enterprises--the TOS-Kurim (CSSR) and the 7 October Machine Tool Building Combine (GDR).

What gains they have achieved in the increase of the technical level of products, what role cooperation with the fraternal countries in playing in this and the direct ties between their collectives were spoken about during the discussions of our correspondent with the executives of the three industrial giants.

There took part in the discussions, which were organized by the Main Editorial Office:

from the Stankostroitel'nyy zavod imeni S. Ordzhonikidze Production Association:

Nikolay Chikirev--general director, Vladimir Isanin--deputy general director for production, Petr Levashov--chief designer, Vyacheslav Kudrin--secretary of the party committee, Stepan Bragin--chairman of the trade union committee.

from the TOS-Kurim:

Jozef Vejrosta--general director, Dusan Berka--deputy general director for export, Jan Kolarik--chief of the research and testing division, Vladimir Merta--chairman of the party committee, Vladimir Bednar--chairman of the plant committee.

from the 7 October Combine:

Erich Reim--general director, Hans-Peter Kilius--deputy general director for new equipment, Hans Eiselt--chief of the international division, Hans Neblung--party organizer of the central committee of the combine, Jurgen Hunneshagen--chairman of the collective of chairmen of the trade union committees of the combine.

The Goal: The Automation of Production

N. Chikirev: As is known, machine tool building is one of the leading sectors of the national economy. The efficiency of the work of plants and associations, the quality and competitive ability of the items being produced by them in many ways depends on the level of its development. Therefore the further improvement of the sector is acquiring today statewide importance and is at the center of attention of the party and government.

As to our enterprise, in brief, the tasks facing it are the introduction in production of the latest achievements of science and technology and the extensive use of advanced know-how. Everything is subordinate to a single goal: the making of profound qualitative changes in the structure and technical level of the economy and the change of its very appearance.

V. Isanin: I will recall that our basic products--standard-unit and special machine tools, automatic lines for metalworking--are automated equipment, which is unique in complexity, precision and productivity. Some 80 percent of it has been certified for the State Seal of Quality and conforms to the best world models. It enjoys an extensive and stable demand both in our country and abroad.

Today the production of NC machine tools of a new generation has been set up here. Automated sections made up of these machine tools and robots have been placed into series production. The time, when readjustable automatic lines, which include robots and computer control, will become the "calling card" of the association, is no longer far off. This is the basis of so-called unmanned production. The development of the corresponding equipment for it--such today is the most important task of our enterprise.

N. Chikirev: We have every reason to be confident that we will also cope with this task. I say "also," because we have more than once fulfilled responsible assignments. I will cite one example--the most complicated orders of the motor vehicle giants, the Volga Motor Vehicle Plant and the Kama Motor Vehicle Plant. We developed the machine tools and automatic lines for them simultaneously with the most prominent foreign firms. And the machines, on which the emblem of our association was, were not inferior, and in a number of instances were superior to them in productivity.

Today we have been commissioned to provide with highly efficient equipment the plants which are preparing for the production of the Don-1500 combine. This, Comrade Yu. V. Andropov said during the visit to our plant, is a very essential machine, for which our country is waiting. Therefore the entire collective--designers and engineers, workers and assemblers--is living by one thing: to fulfill this responsible assignment on time and with a high quality. I should note with pride: the greatest domestic and world achievements found reflection in the designs of about 100 lines, which have been delivered to the Kharkov Serp i molot Plant for the output of this machine.

P. Levashov: A few words about how we are achieving such results. Annually 70 percent of the products of the association are new machines and equipment. Of them 18-19 are authors' inventions. I want to dwell in more detail on one of them: this is a quickly adjustable automatic line for the machine of parts of intricated shape. Here each robot up to now has attended two machine tools. As of this year it already attends five. The fact that the equipment was awarded the Gold Medal at the Leipzig Spring Trade Fair, attests to its technical level.

V. Kudrin: As we see, our design bureau is keeping in touch with the pulse of life. For in our age of the scientific and technical revolution to stand still means to go backward. Therefore we regard the fulfillment of the assignments on the development of science and technology, that is, the development of new equipment, as one of the prime indicators of the activity of the association.

V. Isanin: People may ask: What specifically does new equipment provide, how is it promoting the accomplishment of the main task of the current 5-year period--the intensification of production and the increase of its efficiency?

In 3 years of the current five-year plan our association produced about 2,600 machine tools and more than 100 automatic lines, which have provided the national economy an economic impact in the amount of 50.7 million rubles and have saved the labor of 17,000 machine tool operators. Whereas in 1971 each automatic line, which was produced by the plant, provided an average annual impact of a little more than 50,000 rubles, in 1983 it provided an average annual impact of almost 200,000 rubles.

E. Reim: Before proceeding to the affairs of our combine, I would like to emphasize that the campaign for scientific and technical progress is a sign of the times. The 10th SED Congress indicated this with new force. Comrade Erich Honecker, while speaking about the economic strategy for the 1980's, stated: "The scientific and technical revolution has become the basic reserve of the growth of the economic might and the increase of the efficiency of the entire national economy."

This policy is the alpha and omega of the activity of the administration of our combine, its party, trade union and Free German Youth organizations and the entire collective.

The main task, which we are working on today, is the renunciation of the production of traditional general-purpose machine tools and the changeover to machine tools with microelectronic control and the extensive use of industrial

robots. We have already achieved much in this direction. The single-spindle lathes, which are being produced at present, all are equipped with a system of dead center alignment. Microprocessors have also been installed on gear-cutting machines. They make it possible to save up to 20 percent of the metal and increase the productivity by 20 percent. The adjustment and readjustment of the equipment have been simplified. The norm of service has been decreased.

Machine tools with robots and various magazines are also being developed. We have already demonstrated one of them--a lathe--in 1983 at an exhibition in Paris. Another one--a gear-cutting machine--will be displayed in 1984 at the spring trade fair in Leipzig. Other models of highly productive, including precision, equipment are also receiving a start in life.

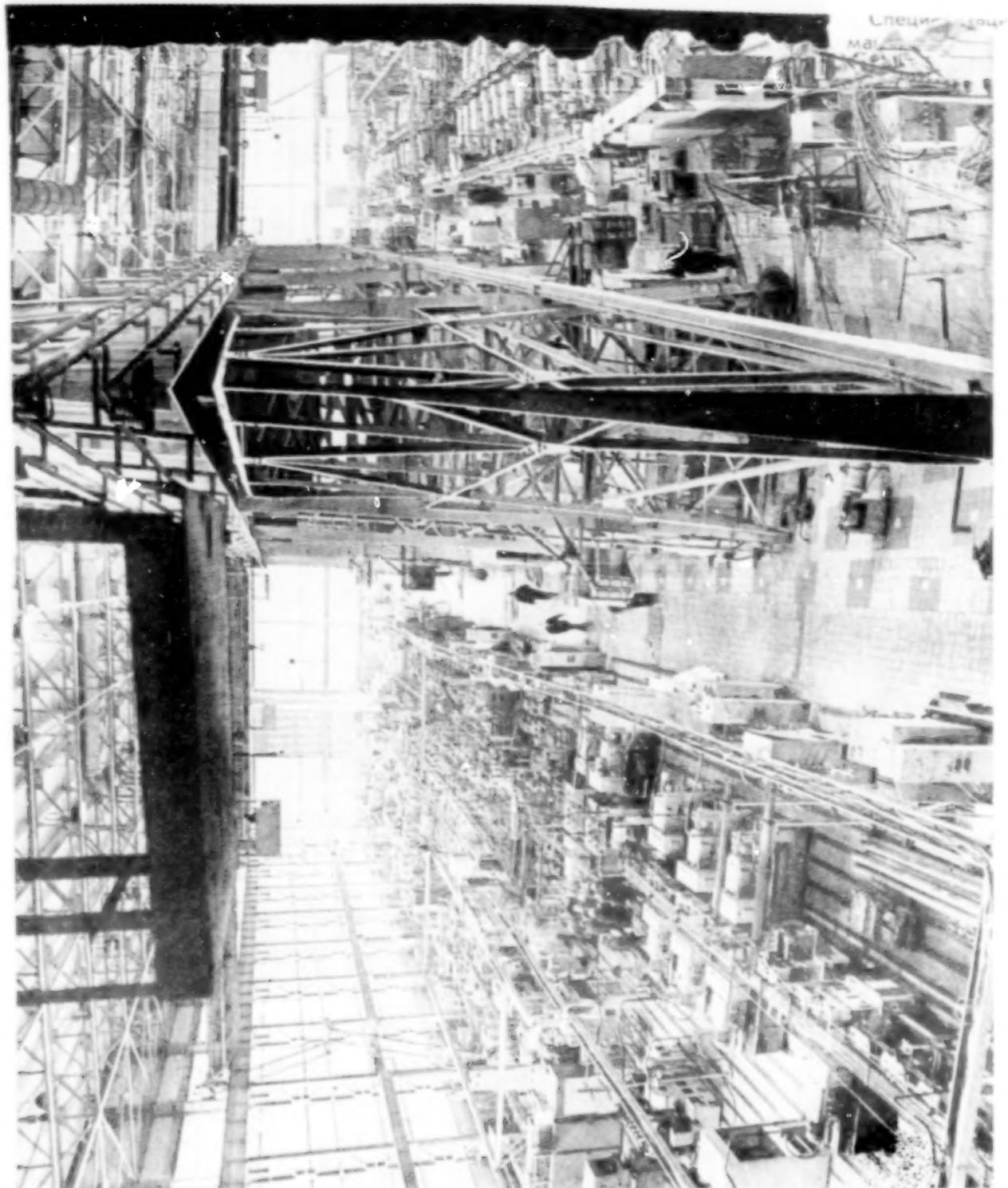
H.-P. Kilias: For all the plants of our combine the proportion of new items is along the basic indicators. In 1983 it came to 23 percent. This means that almost a fourth of the products were produced for the first time. Approximately the same proportion of the latest items will be maintained during the subsequent years of the five-year plan. Only in this way will we be able to keep pace with scientific and technical progress and create the basis for the next stage of the development of productive forces--the complete automation of production.

J. Hunneshagen: Not only the state assignments--5-year and annual, but also the obligations, which individual collectives and production workers are adopting for the year or by a memorable date, are aimed at this. In 1982, for example, they were devoted to the 65th anniversary of Great October and the 60th anniversary of the founding of the USSR, while in 1984 they are devoted to the 35th anniversary of the formation of the GDR.

The occupation of machine tool builder is a creative one. Hence, it is necessary to seek means of the increase of the quality and technical level of products. Today this is one of the most important statewide tasks. And it is being worked on by all the units of the economic mechanism and by all the workers of our republic.

J. Vejrosta: The same tasks are also arising here, in Czechoslovakia. The Government Presidium in January 1979 adopted a special document--The Concept of the Development of Machine Tool Building. Being the strategy of technical progress for the 1980's, it envisages the further automation of mass and small-series production and the extensive introduction of high-precision machine tools, automatic lines and automated sections. The use of micro-electronic structures in the control systems of machine tools is acquiring particular importance.

Today the TOS-Kurim is the basic producer in the country of standard-unit machine tools and processing centers. Among the new items are milling machines with the automatic change of tools, diamond boring precision machine tools of the latest models, processing centers, which are equipped with microprocessors, and others. They are all being produced in series, and this is yielding a large economic impact.



Assembly Shop of the Plant imeni S. Ordzhonikidze

J. Kolarik: The use of one automated machine tool provides an annual saving of 700,000 kWh of electric power and about 30 million korunas of investments. But in a year we produce several hundred such machine tools.

The integrated production section with the stamp of Kurim is also highly efficient. Included in it are 11 NC machine tools, including 5 processing centers. A computer controls the gigantic complex. The section machines 7,800 base members a year. The combination of the latest equipment of different kinds made it possible to decrease the labor intensity of operations by 55 percent.

J. Vejrosta: Today we are already thinking not only about the immediate future--the remaining years of the current five-year plan, but also about the most distant future--1986-1990. For the Concept of Development, which we have spoken about, is designed for two 5-year periods. Therefore today it is already necessary to create a reserve for tomorrow.

In what directions are efforts presently being concentrated? In the same ones as for our colleagues from Moscow and Berlin. In short, this is industrial automation. The development of precision equipment: high-precision machine tools and automatic lines, which make it possible to save a large amount of metal, energy and working time, is acquiring particular importance.

J. Kolarik: Here new processing centers with increased precision are being placed in the forefront. It is planned to assimilate their production during the next 5-year period. But we are already now striving to develop qualitatively new equipment, which does not have analogues in Czechoslovak machine building. It will correspond to the fifth, highest degree of precision according to CEMA criteria.

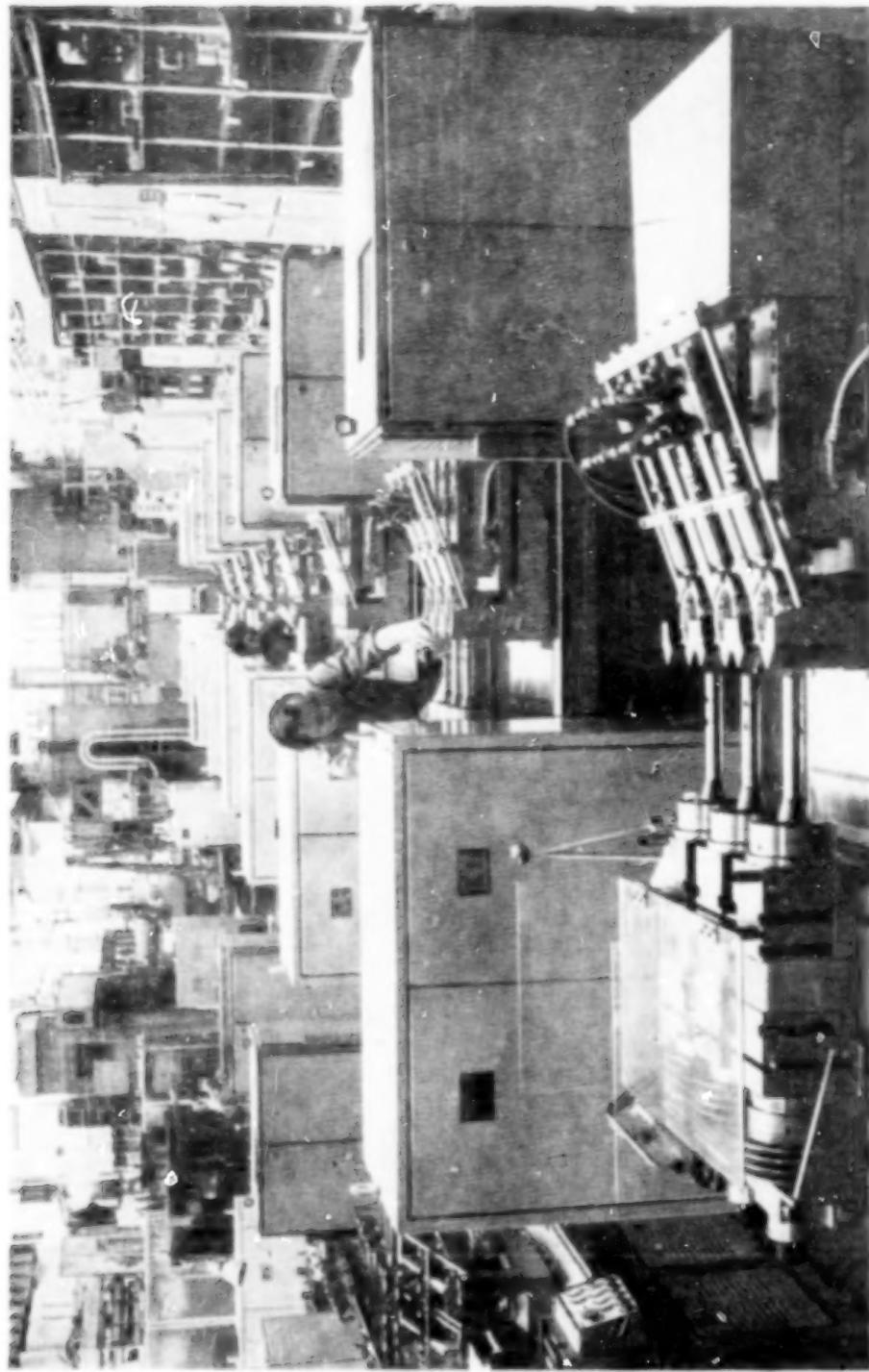
Much is also being done in the area of milling machines. We are achieving an increase of their versatility. We are developing new models with a transverse head.

The development of machines and entire subdivisions without attendants is a subject of particular concern of our designers. This will play an important role in the increase of the productivity and degree of economy of equipment and will help to take a new important step in the retooling of the national economy and thereby in its intensification.

By Developing Cooperation

N. Chikirev: This task is a complex and multilevel one. In order to achieve success, it is necessary to use all possibilities.

As practical experience shows, cooperation within CEMA is of particular importance here. This idea was clearly expressed at the 26th CPSU Congress. At present, it was noted at the congress, it is impossible to imagine the confident development of one fraternal country or another and the successful solution by it of such problems, for example, as the introduction of the latest achievements of science and technology without relations with the other socialist countries.



Assembly of Diamond Boring Machines at Kurim

H.-P. Kilias: Our example confirms this in the best possible way. Everyone knows: so that production would be efficient and would produce products of a high level, it should be large-series.

How are we achieving this? Owing to the fact that a guaranteed sale is ensured for our products on the markets of the fraternal countries, and first of all the Soviet Union. It would not be an exaggeration to say that without this market and without these relations our existence as a combine would be inconceivable. I will cite one figure: we annually deliver to the Soviet Union alone almost 50 percent of all the machine tools and other equipment, which are produced at our enterprise.

H. Eiselt: At times they ask the question: Does not a guaranteed sale hinder the increase of the technical level of products?

There can be only one answer: by no means! For the 5-year agreements on the commodity turnover do not automatically ensure the export of some items or others, but merely create opportunities for this. The specific list and the technical characteristics of items are specified by trade protocols for each year. And here, as they say, kindly lay out only high quality products. Otherwise the partner will not take them. Therefore the market of the fraternal countries is guaranteed only as long as we guarantee a high level of the machines. And this means that every time it is necessary to offer something new, and something which corresponds to the best world models.

D. Berka: This is one aspect of the question. But there is also another, no less important one. It is a question of two multilateral agreements which have been concluded within CEMA in recent years.

One of them, which was signed on 10 September 1980, envisages the international specialization and cooperation of the production of machine tools (including with numerical control), automatic lines, special and heavy-duty single-design machine tools, as well as components, assemblies and technical accessories for them. The other, of 20 November 1979, is on scientific and technical cooperation in the further improvement and the development of new types of machine tools and automatic lines. They have played an important role in the improvement of the structure of our machine tool building.

I have in mind first of all the fact that the agreements have promoted the decrease of the assortment of the products being produced. This made it possible not to disperse forces and assets, but to concentrate them on the accomplishment of a smaller number of tasks. As was noted above, at our plant the stress has been placed on the development and production of machine tools of advanced design decisions, with a higher degree of automation, that is, those which enjoy a large demand both within the country and abroad. We have also begun to devote particular attention to the production of component units for deliveries to the fraternal countries.

I will cite one example. We have begun to produce here so-called ball pairs. They increase the precision of machining and decrease the energy consumption. At present the fraternal countries are importing a significant quantity of these items from capitalist states. Now we will gradually be able to meet the needs of our friends.

NC Semi-Automatic Lathe Produced by the Plant imenI S. Ordzhonikidze



N. Chikirev: There is another question, on which I would like to dwell--the management of the integration process. The present stage is posing this question in a new way and requires its further improvement.

This concerns all the units of the economic mechanism. And not only the central ones--planning organs and ministries, but also associations, combines and enterprises. Not by chance during the visit to our plant was Comrade Yu. V. Andropov interested in how our direct contacts with related industries in the fraternal countries are being developed and in what we are doing so that they would become more comprehensive and meaningful and would help in everyday work.

J. Vejrosta: This problem today is actually very urgent. It is also at the center of attention of our party and state leadership. While indicating its role in the intensification of the specialization and cooperation of production, Comrade G. Husak at the 16th Congress of the Czechoslovak Communist Party stressed: it is necessary to broaden the existing forms of direct ties with the corresponding organizations of the CEMA member countries and to seek new ones.

E. Reim: The changeover of the economies of our countries to the intensive means of development requires a set of measures both within each country and in the area of international cooperation.

One of them is the establishment and steady improvement of cooperation on the microlevel. Without this it is many times harder to utilize fully the achievements of friends, to avoid duplication in scientific research and planning and design work and to use the available forces and assets most efficiently. And no matter how difficult this problem may be, we should solve it. For direct ties promote not only the acceleration of technical progress, but also the development of truly internationalistic, fraternal relations between labor collectives and individual production workers.

V. Kudrin: Yes, this matter, undoubtedly, is necessary and important. But here for the present there are many unresolved questions. Nevertheless definite successes are already in evidence. At present 1,300 Soviet production collectives are maintaining direct ties with approximately 1,500 enterprises of the fraternal countries. Our Machine Tool Building Plant imeni S. Ordzhonikidze is also among them.

The Czechoslovak comrades, who were the initiators of the establishment of regular contacts, I believe, will tell better about how the friendship between it and the TOS-Kurim has grown stronger.

V. Merta: In 1956 the management and party and trade union organizations of our enterprise invited the workers of the Plant imeni S. Ordzhonikidze to the Second International Machine Building Trade Fair in Brno. And Kurim, as is known, is located 20 km from it. The Moscow machine tool builders visited us. The meeting was very cordial. We familiarized our friends with our experience and achievements and told about the tasks which we were working on. They proved to be identical to the ones which faced the Muscovites. And since the tasks coincide, the desire to cooperate and to help each other appears. And at that time the idea originated: to conclude an agreement on international

competition. It was signed in 1957--the year of the 40th anniversary of Great October. Since then our meetings have become regular.

During this time the mutual obligations have changed and been supplemented. But the goal has remained constant: the extensive promotion of the Marxist-Leninist principles of socialist internationalism and the friendship of peoples, the exchange of advanced know-how and achievements. And not only in the area of production, science and technology, but also the organization of competition, material and moral stimulation and so on. And this has promoted the achievement of high indicators in work, and particularly the assimilation of new equipment. The agreement on mutual cooperation between the communist youth organizations of the two fraternal countries also played an important role here. From year to year the contacts in the area of culture, tourism, recreation and work with children have also broadened.

H. Neblung: The cooperation of our collective with the Muscovites has developed in a slightly different way. Friendly relations between us were established in 1973. At that time new highly productive machine tools with the mark of the Plant imeni S. Ordzhonikidze and the Krasnyy proletariy Plant began to arrive at our combine.

This was of great economic and political importance, since it made it possible to increase substantially the technical level of production and confirmed with new force the great effectiveness of bilateral and multilateral cooperation with the fraternal countries. For owing to Soviet machinery we were able to set up here the production of the latest equipment. Moreover, not only for domestic needs, but also for export to other CEMA member countries.

These deliveries also played an important role in the development of direct ties between the workers and specialists of our countries. For at that time installers from these enterprises also came to us. They helped to install the new equipment and taught our comrades to operate it. In turn our representatives visited the Plant imeni S. Ordzhonikidze.

Subsequently our contacts were developed through various channels. One of them is the Trains of Friendship, owing to which 300-400 of our workers and engineers annually visit the Soviet Union. And each time they meet the workers of the Plant imeni S. Ordzhonikidze and exchange experience and achievements with them.

The agreement on friendship and socialist competition, which was signed in November 1982, was a new important step, which legalized our relations. The same goals, which the workers of Moscow and Kurim have, are outlined in it. As is noted in the document, it is a contribution to the Treaty on Friendship, Cooperation and Mutual Assistance Between the GDR and the USSR and serves the further extension of the fraternal relations between their capitals--Berlin and Moscow, between the machine tool builders of the two socialist countries.

S. Bragin: The question may arise: But what specifically do these ties give? With what are the enterprises "enriched" from contacts and meetings?

I will cite specific examples. During one of the visits to our association our Czechoslovak comrades, while familiarizing themselves with the organization of production, took an interest in the automatic lines, which were being produced for the second section of the Kama Motor Vehicle Plant. The equipment had a higher technical level than that previously delivered to the motor vehicle giant. The new models of machine tools, which make it possible to increase labor productivity by 10 percent and to save the labor of not less than 5,000 workers, also attracted the attention of the guests. They also studied with great interest the experience of the development and introduction of fast-acting spring- and hydraulic-actuated machine tool accessories. As the colleagues from Kurim stated, the meeting made it possible to use this know-how at their enterprise.

In turn the specialists of our association are returning from their friends, having adopted their achievements and technical innovations. Thus, the workers of Kurim have developed a new high-speed high-precision method of the final milling of guide beds, which is used instead of traditional grinding. The modernization of milling equipment, which yields a large economic impact, is the basis for this method, which we adopted from our friends. We also used the experience of our friends when producing screws with ball pairs for NC machine tools.

V. Bednar: Comrade V. Merta has already stated that our contacts are not confined to production spheres, but also encompass other spheres.

The ties between brigades and individual workers are coming to the forefront here. It has already been many years that friendship has been established between the women crane operators of the brigades, which are headed by Anezka Gotwaldova and Mariya Rossikhinova, the fitters of the brigades of Bohumil Lovetinsky and Nikolay Fedin, the workers of plant laboratories and others.

Another important form of contacts is the relaxation of children at Pioneer camps, kindergartens and holiday hotels of related enterprises. Now 35 children of the workers of Kurim annually spend their vacation at children's institutions of the Plant imeni S. Ordzhonikidze. The same number of Moscow children vacation at the holiday hotel of the TOS-Kurin in the Vysoke Tatry mountains.

Since last year the workers of Kurim with their families have also been spending their vacation at the sanatoria of the Moscow machine tool builders. And they in turn are vacationing with their Czechoslovak friends.

J. Hunneshagen: While developing contacts with the workers of the Plant imeni S. Ordzhonikidze, we are using the available know-how, but are also introducing in it something new, something of our own. Thus, in the production area in addition to the regular visits of delegations and the exchange of achievements we are planning such a form of ties, which has justified itself, as "from machine tool to machine tool." The best production workers of the 7 October Combine will work and share their experience at the Plant imeni S. Ordzhonikidze. While our Moscow colleagues will come to us and demonstrate their methods of labor. More and more attention will be devoted to the development of socialist competition, political, ideological and educational work, the organization of labor and the means of increasing its

productivity. We are also discussing the possibility of the joint vacationing of workers and their children.

Thus, a start has been made. Now what we will be able to achieve, depends on us, our initiative and activeness. This matter is important and useful. And it is necessary to do everything so that it would yield the maximum impact and would play a greater and greater role in the solution of both production and social problems.

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UPDATE ON ECONOMIC EXPERIMENT IN SOVIET MACHINE TOOL PLANTS

Moscow IZVESTIYA in Russian 9 Mar 84 p 3

[Article by V. Romanyuk, economic observer for IZVESTIYA: "Incentive for Discipline"]

[Text] Two months under the conditions of an economic experiment...that is not such a long time. Nevertheless, however, it is a sufficiently long interval to accumulate some kind of experience--perhaps insignificant but quite concrete--and to receive some food for thought and possibly to make some corrections.

At the time of our January meetings (IZVESTIYA No 21-22, 23-24), Stanislav Vladimirovich Demidovich, general manager of the Moscow electrical machine building association "Dinamo" expressed his fears in regard to possible failures to receive an entire series of complementary articles and materials. The general manager's fears were justified. There were failures from the very first days. And among the undisciplined suppliers were enterprises in his own branch participating in the experiment with equal rights.

"The association is not fully meeting the plan for deliveries," says Demidovich not without regret. And he quickly adds: "But we did not count on complete success from the start of the experiment. It would have been naive to count on that."

However, we do sense progress. The collective concluded last year with 87 percent of the plan for deliveries, whereas the result for January 1984 was 95.9 percent and for February it was 96.2 percent. To some people, this calculation may seem boring, but for a worker at Dinamo it has almost the sound of a heroic symphony.

Yes, a noticeable turning point has been achieved, although it is still not a complete success. And yet, the completion of all of the contracts without exception promised a 15-percent increase in the material incentive funds, and here each percent of real deficiency resulted in a loss of 3 percent in the resources allocated for these purposes. In short, the plant's engineering and technical workers were awarded only R19,000 in bonuses in January in the experiment. But that is something already! The stimulus started to "work." To be sure, the bonus could amount to R37,000.

For the first time in many years, the meeting of the accounting commission was stormy. The argument flared up about the payment of bonuses to the castings and forgings shops. Many of them reported 100 percent deliveries and laid claim to more substantial bonuses than the finishing shops. But their unrhythmic work over a period of months left no opportunity for shops and departments involved with final assembly. "What right do the forgings and castings workers have to receive full bonuses when they let us down for the entire month?" said the assemblers. In the end, the size of the bonuses to the castings and forgings shops was reduced. The commission recommended that they be concerned about creating a "reserve of solidity" along the entire technological chain.

The agreement on deliveries, very solidly supported by material incentives, nevertheless turned out to be the most vulnerable item, even with all of the careful development of the plans for production and material and technical supply. About 1,000 electric crane motors were not assembled because the copper was not of the required assortment; "Moskabel'" held up the shipment of enameled wire having the most current cross sections. There were 300 motors in the warehouse, but that did not change the overall situation. At the final curtain, 31 January, the cable workers shipped the last 18 tons of enameled wire. They reported completion of their obligations and they "got the best" of the Dinamo workers, for it takes more than a week from the receipt of enameled wire until the machine is released.

I wanted to visit the main administrative shop and meet with my old acquaintance, shop chief Vladimir Sergeyevich Ovchinnikov. I remember that at the beginning of the year he was full of hopes and now, I noticed, his enthusiasm had waned a bit. In the shop, they had particular hopes on the section for consumer goods, where a new model vibropump for horticulturists was put on the conveyor, a model that is less materials-intensive but more productive. And what about it? Of 20,000 pumps, only 14,500 were assembled in January. And matters were even worse in February. V. Ovchinnikov feels that the association's management is responsible for that.

When the change to a new model of vibropump was being planned, the Moscow plant "Vulkan" was designated supplier of rubber shock absorbers. But at the very last moment, it turned out that the plant, claiming a large backlog in the production of rural sprinkler systems, did not include 120,000 shock absorbers in the plan. Seeing that the department for cooperation had acted carelessly, Ovchinnikov sounded the alarm, but it was only in the third 10-day period that the general manager was able to go to "Vulkan." The supplier gave assurances that the obligation will be eliminated in March. The time, however, was lost. Ovchinnikov told me that the collective was not sitting on its hands and hopes to correct the situation.

The production of traction crane motors began to move out of the group that was lagging behind. In January, the collective was short of the plan by only two motors--that is 0.3 percent of the plan. To be sure, this fraction of a percent was enough to keep the collective from receiving the 15-percent increment that is provided for flawless implementation of the delivery plan. Aligber Faidarakhmanovich Andyarzhanov, production chief, later acknowledged

that in no way did he expect such a turn of events. The terms of the experiment are known to all, but for such a trivial matter to influence the size of the bonus in such a way. "We will not again lose out on this 15 percent," he declared at the meeting of the accounting commission. And indeed, the collective is now exceeding the schedule in its production. There is a need for that. Experience has shown that to ensure 100-percent fulfillment of contractual deliveries, at least a 5-day time reserve is needed to put together and send the production to consumers. And today the effort to surpass the plan has unfolded in all shops and in every sector--all along the technological chain. Perhaps the most noticeable feature of the experiment is the strengthening of planning discipline at the shop level.

To tell the truth, even now the very complicated mechanism of the economic experiment is not clear to all. In my presence, deputy general manager Leonid Anatolyevich Galishnikov instructed, and apparently not for the first time, Velenia Nevezorova, head of the planning-economic bureau of the second administrative shop:

"The product-mix plan is to be translated into full assortments of components," continues the rebuke. "This will be innershop planning. Also, the work was not allocated to the new equipment."

"We had no new equipment. The chief technologist did not provide for it."

"You yourselves should have made provisions. There is a technical bureau in the shop, and the technical guaranteeing of the plan is the indispensable condition for its implementation." The "examiner" reflects a moment, rubbing his massive chin. "What do you say, was there not even a rearrangement of equipment in the shop?"

"I do not know."

"There you have it! We want to convert the economic service into a center of economic management and we do not know the most important thing."

L. Galishnikov takes another "mold." It follows therefrom that under favorable conditions the material incentive fund for the shop's engineering and technical personnel would amount to R1,750. But according to results of January's work, only R1,069 were paid out. Is that not a drastic cut? No, everything is as it should be. The shop was 2 percent short of its delivery plan.

The unified material incentive fund is not unified at all. It contains three components. Contractual deliveries "drain" 60 percent of this fund. Another 20 percent is paid out for the introduction of new technology and an equal amount goes for lowering expenditures per ruble of commodity production. In all three categories, the indispensable condition for the awarding of bonuses is the reduction in losses of working time. Taken as a criterion is the coefficient of the use of labor time, attained last year. It, of course, is a conditional mark but in any case it is a real point of reference. In 1983, the coefficient was 0.78. In January in the second administrative shop, it was 0.89. Was not everything too easy? L. Galishnikov smiles: easy so far. In February, the January index became the "base," and therefore it was

necessary to be involved more seriously with increasing discipline and with establishing order in production, as well as with disclosing intrashift losses, without which there can be no dynamics in this important indicator.

Resounding anew under the conditions of the economic experiment was the "firm's" Dinamo method of planning at the level of each work place. Initially having begun with an evaluation of the results in standard hours, Dinamo workers then went to a more tangible and more readily understandable indicator--the standard ruble. But now this indicator contradicts the conditions of the experiment. The standard rule requires larger and more expensive production, whereas the experiment's orientation is toward the final result--precise fulfillment of deliveries. Instead of the standard ruble, they began to link with each work place the shift task in the products list, a task that is formulated in consideration of the requirements of the deliveries plan. Everything that is beyond the limits of the shift task is excluded from the volume completed by the brigade or section.

"The experiment includes an extension of cost accounting and plan stabilization," says Galishnikov. "Now we want to transfer this idea of the experiment to intrashop planning, to the section and the brigades. This, in turn, requires modernization of the Dinamo method itself."

The result is that with the start of the economic experiment the Dinamo method takes on new life. Of course, no indicator works automatically. Much is determined by quality and the level of management. There is a noticeable increase in the role of the foreman, the key figure in the section. It is considered that the foreman can manage a collective with no more than 25 people. That, in a manner of speaking, is his "management ceiling." Now the nature of the foreman's work is changing. The focus of attention is control of the implementation of the full complement of junctions and components. Naturally, this has added work, but the salary of foremen increased by R60 to 70.

"The first months of the experiment answered some questions but also provoked new questions," says Nikolai Aleksandrovich Antonov, secretary of the party committee of the "Dinamo" plant, contributing to the conversation. "In developing a system of material incentives, our economic services assigned priority orientations for each subdivision and, as they say, they brought the funds to the brigade. But here is the question: Where does one get the resources to encourage good workers when the plant as a whole is not meeting its deliveries? For we can only pay bonuses from what the plant 'earns,' and the result depends on external factors."

Already working under the conditions of the experiment, Dinamo workers obligated themselves to increase labor productivity to 1 percent above plan and to reduce production costs by 0.5 percent. Economists calculated that more can be attained in the second indicator, but the corresponding withholding for the incentive funds should be at least doubled. They are still insignificant.

"I feel that the experiment has gotten off to a good start," said Demidovich with reserved excitement. "Of course there will be difficulties.... It is important that the people do not lose vital interest in the experiment and its results and incentives, as well as in personal participation in lower-level planning."

For some managers, it was noted at the February plenum of the Central Committee, awaiting the results of the experiment serves to cover their passivity and their striving to do things in the old way. Alas, there are also such people among the partners of the "Dinamo" plant. No one has sterile cleanliness in which to carry out the experiment. But one must agree that tripping up one's partner is not the best means of verifying his solidity. Through initiative and ardent interest in the matter at hand, Dinamo workers are determining their role in the experiment as "disturbers of the peace." Yes, stabilizing deliveries is an important link in the economic experiment. But stable deliveries are not just the timely receipt of enameled wire and a substantial raise in salary. It is also the careful preparation of production, the strengthening of the tool base and the introduction of advanced equipment, doubling and tripling the collective's capabilities. It is the psychological tearing down of well-developed stereotypes of thinking and action. In the next letter, we will speak of how Dinamo workers, under the conditions of the economic experiment, gradually go the way of technological renewal, improving the economics of production.

9746

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INDUSTRY PLANNING AND ECONOMICS

LONG-RANGE, INTER-BRANCH PLANNING OF AUTOMATION PROPOSED

Moscow MASHINOSTROITEL' in Russian No 12, Dec 83 pp 30-32

[Article by V.V. Gol'bert and candidate of technical sciences V.G. Lisitsyn:
"The Program, Goal-Oriented Approach to Automation of Control Processes"]

[Text] Work on goal-oriented scientific and technical programs has made it possible to solve a number of very important intersector scientific and technical problems connected with developing and assimilating new, highly efficient equipment and technologies and conducting scientific research. However, the advantages of scientific and technical programs in reinforcing the goal-oriented direction in planned measures and enhancing the degree of comprehensiveness in their development and implementation, and also centralization of the levers of control over fulfillment, are still being inadequately used.

The scientific and technical tasks included in the programs worked out by the USSR State Committee for Science and Technology are interconnected and require the program, goal-oriented approach when they are incorporated in scientific and technical automation programs. Analysis of the scientific and technical programs of the 10th and 11th five-year plans has shown that the majority of such tasks are of an intersector nature. This means that the tasks included in several scientific and technical programs should be connected by a common technological thread in the process of developing new equipment and automated systems; head scientific research institutes responsible for development, and the coexecutor organizations identified; and calculations made to insure the proper labor and financial resources for each task, with due consideration of any constraints.

However, not all scientific and technical automation programs meet these requirements. This is mainly the consequence of the existing practice of drawing up goal-oriented, comprehensive programs whose basis is the principle of satisfying proposals coming from ministries and administrations in the last year of a current five-year plan. The methodological materials compiled by the USSR Gosplan and the USSR State Committee for Science and Technology deal mainly with forms for the presentation of scientific and technical programs, and they throw virtually no light on questions of formulation, selection and coordination of tasks. Hence a certain randomness in the inclusion of given tasks in scientific and technical programs and their poor goal-oriented nature, and also the complexity involved in reviewing in a single document methods for the formation of tasks in different scientific and technical programs.

Because of this it is necessary to develop a methodological document for the compilation of five-year scientific and technical programs for the automation of planning and control processes that would establish a unified strategy for the development of multipurpose automated systems, taking into account the main directions in improving the economic mechanism as determined by the 26th CPSU Congress and CPSU Central Committee and USSR Council of Ministers decrees, and also industry's capacities for producing computer equipment. This document should become a long-term, goal-oriented program for the development of the automated control system envisaged by the target in the scientific and technical program for the 11th Five-Year Plan to solve the problem of developing and introducing new automated control systems and developing existing systems in all-union and republic organs and oblast organs, and also for conducting work to amalgamate the automated control systems at various levels into a national automated system for the acquisition and processing of data for accounting, planning and management.

The purpose in developing a long-term, goal-oriented program is to agree work and coordinate the introduction of measures to improve the management system at all levels and in all sectors of the national economy, based on the practical application in management activity of a system of mathematical-economic models, computers and data transmission facilities for both internal administrative (intersector) and collective use. It is proposed that effectiveness in these measures will be achieved given that they are introduced simultaneously in all interconnected spheres of national economic management, and also necessarily cover mutually determinant components of control systems such as methods, structure, equipment, technology and management personnel.

The long-term goal-oriented program should be regarded as a comprehensive program solving basic scientific and technical problems in the further development of automated systems and enhancing their efficiency. Its realization should be effected during the course of development and fulfillment of the five-year scientific and technical programs of the State Committee for Science and Technology and the plans of the ministries and administrations along the main directions of automating the processes of planning and control, and also the five-year plans for introduction confirmed by the USSR Gosplan and the union republic planning committees. Here, long-term plans for the introduction and production of computer equipment and the use of capital investments to construct computer centers will be the resource base for the large-scale realization of scientific research, experimental and testing work carried out. As a methodological document, the long-term, goal-oriented plan will insure the following:

- comprehensive scientific and technical programs covering all the many aspects of developing automated control systems and their interaction;
- a substantiated step-by-step approach in solving scientific and technical problems;
- unification, type norming, and standardization both of the automated control system as a whole and of its components (technical, data and software);

- centralized control over the development and introduction of standardized design decisions in the development of automated control systems and collective-use computer facilities;
- coordination of tasks in scientific and technical programs with the section of the state plan dealing with control improvements;
- the required scientific and technical level for USSR Gosplan and sector ministry and administration introduction plans;
- the economic efficiency of and justification for the automated control systems developed and the organization of their interaction;
- the methodological and organizational unity of decisions in interdepartmental control tasks;
- methodological and organizational solution of questions of designing, introducing and using collective-use computer facilities;
- data, software and technical compatibility between automated control systems at different levels when solving interdepartmental tasks;
- reducing the amount of time taken to design automated control systems and their individual elements, and collective-use systems and the entire system as a whole.

The concepts of developing a statewide automated system [OGAS] and design decisions for OGAS developed and functioning at all levels of national economic control (directive, intersector, sector, production and territorial) form the basis for compilation of the long-term, goal-oriented program. Within OGAS, data, software and technical facilities should be linked on a common methodological, technological and organizational base, and collective-use data processing facilities should also be developed. This kind of unification makes it possible to reduce costs for the design and operation of automated systems, and it also creates the prerequisites for their combined operation and automatic interaction in the realization of data-linked tasks in control of the national economy as an integral and uninterrupted process. This results in a marked improvement in the efficiency of social production through improving management and bringing it up to a modern scientific and technical level. The coordinated developed of automated systems of various kinds, the creation of computer centers for collective use and the production and introduction of data processing equipment in management have predetermined the designation and goal-oriented direction of the long-term, goal-oriented program as a unified planning and methodological document for solving problems involving automation of national economic control.

This problem is resolved by the long-term, goal-oriented program along three main, interlinked directions that combine design and introduction tasks such as the following:

- improving the efficiency of automated systems for national economic control on the basis of the opportunities offered as a result of organizing interaction

between automated control systems. For this, provision should be made in the long-term, goal-oriented program for conducting scientific research work to determine the main directions in control improvements at all levels and in all spheres of the national economy on the basis of the use of computer facilities and mathematico-economic methods. The result of scientific research work should be the compilation of organizational-legal and methodological documents dealing with improvement in the functions, structures and processes of control, and also the selection of first-priority tasks in control that can be automated. Practical introduction of the documents drawn up will prepare control organs for operation under conditions of automation, while the purposeful and coordinated automation of tasks for various organs will provide real growth in the efficiency of social production through improvements in the management process;

--the direct automation of control processes in the national economy, taking into account the utilization of computer facilities for collective use. In order to fulfill this task prevision should be made in the long-term, goal-oriented program for the development of structural-functional and technologic schemes for solving intersector and internal departmental control tasks, and also the development of interlinked input-output mathematico-economic models forming a unified system of national economic control;

--the development of a unified data-processing base for the needs of national economic control. In this case, the long-term, goal-oriented program should include tasks for developing software, data and hardware facilities for collective use (countrywide subject-oriented data bases, a state collection of algorithms and programs, collective-use computer centers, state data networks and so forth), taking into account the predictions for the requirements for such systems in national economic control through the end of the planning period. Here, the scales in introducing data-processing facilities for collective use should be linked with the volumes in the development of personal facilities, for which provision is made for the development of standardized elements providing software, data and technical compatibility among automated systems so that they can interact in automatic mode.

It should be noted that the solutions to these problems should as far as possible be oriented on typification, unification and standardization of the final results of developments, including all kinds of documentation.

Development of the long-term, goal-oriented program should be accomplished using the basic principles of program, goal-oriented planning, which suggest the following sequence for the development of programs: constructing a goal tree, defining systems, and formulating a set of measures that realize the goals set. However, realization of the principles of program, goal-oriented planning in the long-term, goal-oriented program is conditioned by the following features in the creation and development of automated control systems:

--the national economic control processes whose automation should be effected within the framework of the automated control system are constantly changing and being improved as a function of the needs of social production;

--the agreed development of an automated control system as a unified instrument of national economic control as a whole should be conducted without interruption;

--development of the long-term, goal-oriented program was initiated almost three five-year plans after the start of automation for management labor, when substantial work was done to develop the various automated control systems and integrate them and the collective-use data-processing facilities were developed.

These features in the creation and development of the automated control system require regular amendments to the long-term, goal-oriented program, for which it is necessary to conduct constant work to delve deeper scientifically and to trace out the goals of improving control in the national economy on the basis of automation; and to clarify the characteristics and, possibly, the makeup of goal-implemented systems, and also the volumes in which they are being produced. Accordingly, the long-term, goal-oriented program should reflect not the sequential order of program, goal-oriented planning, as required by that method, but parallel creation and development of the elements of the automated control system as confirmed by practical experience.

The structure of the long-term goal-oriented program as a planning document covering a long period and subject to periodic amendment, should not only cover all the work required to design and introduce the automated control system, but also provide the opportunity for including in the program new work that occurs in the process of developing systems and the changing requirements for organizing their interaction.

It is expedient to adopt the kind of structure for the long-term, goal-oriented program in which tasks will be grouped according to the following directions:

--the creation of a set of documents for all questions involving improvements in the national economic control system under the conditions of automation of managerial activity, including documents concerning improvements in the structures, methods, technologies and personnel at all management levels and in all sectors of the national economy;

--the creation of a set of documents for the design, introduction and operation of automated control systems, insuring their compatibility and interaction, including documents concerning the development and functioning of methodological, technological, data, software, hardware, organizational-legal and personnel support;

--the development of automated intersector, sector and territorial complexes at all levels of management, such as "Planning Material Production," "Controlling Material-Technical Supply," "Controlling Scientific and Technical Progress," "Controlling Manpower" and other complexes that meet the goals set for management;

--the development of a unified data and technical base for the national economic control system, including direct development, experimental verification and the introduction of system, general, and specialized data, software and hardware facilities.

Subprograms for the creation of individual, goal-implemented elements and systems may be drawn from the long-term, goal-oriented program as independent documents. Features in the grouping of tasks in a subprogram may vary. They should include "unity of object" (a subprogram for creating computer center networks), "commonness of goals" (a subprogram for improving the control system), "unity of realization facilities" (a subprogram for creating legal documentation) and so forth. When distinguishing subprograms from the long-term, goal-oriented program and formulating them in the form of individual documents, the link is maintained between the tasks of the subprogram in terms of time periods, funding and executors and the corresponding interconnected tasks in the long-term, goal-oriented program and other subprograms.

Taking into account the practice of working on and fulfilling tasks in the scientific and technical programs, it is expedient to draw up the long-term, goal-oriented program in two stages.

During the first stage work is done to create and develop automated control complexes and system facilities insuring the following:

--subprograms for the creation and development of intersector control complexes, including a subprogram for the creation and development of an automated planning system, a subprogram for the creation and development of a finance-and-credit complex, a subprogram for the creation and development of an automated control system for science and technology, and other similar subprograms;

--subprograms for the creation and development of sector control complexes for construction, transportation, industry and so forth;

--subprograms for the creation and development of multisector control complexes such as "agro-industrial," "health," "environmental protection" and so forth;

--subprograms for the creation and development of territorial-level automated systems;

--subprograms for the creation of collective-use data retrieval systems.

During the second stage, the long-term, goal-oriented program is drawn up on the basis of the suprograms that have been developed.

The subprograms for the creation and development of automated control complexes, and also the creation of collective-use data retrieval systems, should be developed by the organizations that are in charge of resolving these questions. For those complexes where a head control organ has not been appointed to be responsible not only for design work but also for the functioning of the complex, at this stage it will be sufficient to draw up a long-term, goal-oriented program for the development of integrated automated control systems for the ministries and administrations that will participate in realization of the tasks of the complex.

The long-term, goal-oriented program formulated in this way will combine state interests in the field of strengthening intersector control and improving

efficiency in the use of computer facilities in control, with the individual approach to improving activity by means of developing and introducing automated control systems in sector (departmental) management.

Realization of the entire complex of work envisaged for the long-term, goal-oriented program will make it possible to bring the management system for the national economy up to a modern scientific and technical level as a result of the following:

--improvements in technology for the realization of processes and tasks in national economic control, with the use of the latest achievements of science and technology, insuring additional growth in the economic efficiency of social production;

--the development of a unified system for documentation for the design, introduction and functioning and goal-oriented development of automated systems, reducing lead times and costs in the creation and operation of systems and raising the level of development in automated control systems;

--the production and introduction of national and individual computer facilities for collective use, including subject data bases, algorithm and software libraries, computer center networks and collective-use computer systems, enabling considerable improvement in efficiency in the use of computers and the functioning of intersector, sector and territorial automated systems;

--the creation of national and departmental (sector) specialized services to develop, introduce and operate data processing facilities.

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9642

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AUTOMATED LINES AND AGGREGATED MACHINING SYSTEMS

NEVSKIY PLANT TO RECEIVE MILLIONS FOR CAD/CAM

Moscow PRAVDA in Russian 24 Feb 84 p 3

[Article by V. Gerasimov, datelined 23 February, Leningrad: "Turned Into A Profit"]

[Text] The Nevskiy Machinebuilding Plant imeni V. I. Lenin association has decided to spend two and a half million rubles on mechanizing and automating engineering labor in its design and technological subdivisions and on creating automated control systems for processes in its shops through the remainder of this five-year plan. A substantial sum, to be sure. But the machinebuilders think it will turn into a direct profit. The enterprise is approaching implementation of its technical progress program in a well thought-out manner, aiming towards the future. More than 20 specialized sectors have been organized here this five-year plan, the amount of numerical programmed-control equipment has doubled, and use is being made of group processing methods, brigade forms of labor organization and the servicing of multiple machine tools.

"Advanced technologies and progressive equipment are helping us appreciably lower the labor intensiveness of manufacturing the machines," says G. Velikanov, the association's general director. "For example, thanks to innovations in the manufacture of gas transfer-pump unit rotors, the labor intensiveness of each item has been lowered by 500 norm-hours and assembly quality has been improved. Production modernization will enable us to raise the equipment shift index this year, to exceed the planned labor productivity level and lower output net cost. The collective plans to meet the five-year plan for production volume in October of next year and the labor-productivity growth rate plan by the 115th birthday of V. I. Lenin.

As has the Nevskiy Machinebuilding Plant association, the Svetlana and Fosforit associations, the rail car manufacturing plant imeni I. Ye. Yegorov and the woven-fabric factory imeni Nogin have broadened competition for completion of five-year plan assignments ahead of schedule, under the slogan: "Entire Increment in Production Volume Through Technical Progress, Maximum Equipment Load and Saving Resources." This initiative is based on specific steps to widely introduce progressive technology, mechanization and automation, to develop the servicing of multiple machine tools and the brigade contract, to strengthen labor and production discipline and to use resources effectively.

This initiative by production leaders has been approved by the Leningrad obkom buro, which has proposed that it be extended to enterprises in various branches so as to ensure implementation of the five-year plan ahead of schedule, above-plan labor productivity growth and an additional reduction in output net cost.

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UPDATED TERMINOLOGICAL DISTINCTIONS BETWEEN MANIPULATORS

Moscow MEKHANIZATSIIA I AVTOMATIZATSIIA PROIZVODSTVA in Russian No 12, 1983
pp 18-20

[Article by engineers Yu. M. Soluyanov and B. A. Komel', "What to Call a Manipulator?"]

[Text] We are discussing the article by V. P. Bobrov
"Conditions for Introducing Automatic Manipulators in
Machinebuilding" -- in No 4, 1981 of this journal.

Among the urgent problems posed in this article by candidate of technical sciences V. P. Bobrov is the question of the necessity of expanding the area of using the term "manipulator." It was proposed to use this term only for any devices that are used in materials handling and transportation operations.

In the discussion on the article, almost every participant touched upon the terminology question in one way or another. Many expressed negative opinions on V. P. Bobrov's suggestion. Some did not agree only because they felt that questions with regard to manipulator terminology were already solved and fixed once and for all in GOST 21024-75. The majority of reactions, however, contained various proposals on classifying automatic loading devices, including automatic manipulators, and the terminology related to it. The very fact of the lack of a single opinion among specialists indicates an imperfection in standardized terminology and the necessity of developing a clear classification of manipulators for their successful introduction since, with the created situation, specialists cannot find a common language.

What is the reason for such a situation?

First of all, we fail to think that the existing GOST 21024-75 "Manipulators: Terms and Definitions" treats the manipulator as a device remote controlled by an operator and (or) a programed device, which contains the actuator, intended to simulate the movements and working functions of a human wrist.

While the first part of this definition, that concerns manipulator control, does not evoke serious objections, the second part, obviously, does not correspond to the modern level of development of science and technology. The story of equipment development indicates that the blind copying of solutions

produced by nature or initiating them does not always make it possible to achieve the desired results.

At the first stages of the manipulator building development it was also thought that the truest road is imitation. Since manipulators were first designed to replace a man in machinebuilding, where the production environment was adapted to the possibilities of his hands (the location of machine tool controls, dimensions and weight of the machined products, etc.), these new devices were being produced along anthropomorphic arrangements, i.e., articulated links that reproduce the arrangement of the upper human extremity. True, it was clear from the very start that the creation of a human hand with the same number of degrees of freedom as a man's hand (27), is technically difficult to achieve and hardly advisable. Manipulators designed according to somewhat simplified arrangements with about 10 degrees of freedom were also extremely complicated and had a limited load-lifting range were slow and did not always have sufficiently accurate positioning. Therefore, almost immediately there was a departure from copying the human hand. The first step in this direction was the introduction in the mechanical hand the a sliding pair which, as is well known, does not exist in the human hand. This innovation made it possible to achieve a rectilinear-forward movement of the working member by using only one of the sliding pairs instead of several rotary ones. Material consumption and power expenditures were reduced, and the control process was simplified as a result.

In further manipulator developments, arrangements of the device appeared that did not look even remotely like a hand. Frequently, a sequential mechanical tie was missing between individual links of the actuator as well as a working member in the form of a grip, and the action on the manipulated object was implemented by other methods.

We will describe three characteristic examples, in our opinion.

Example 1. In the MPU-2 automatic manipulator, developed by the Leningrad Machinebuilding Association imeni K. Marx, and intended for servicing machines for reprocessing chemical fibers, the actuator is made in the shape of individual pushers (sliding pairs) and rotary pairs, located on a movable support. Sequential action (according to a given program of these links ties 8.5 kg packages of cords). As it moves along the machine, the manipulators remove the finished packages, orients them properly and places them on an auxiliary transport cart for transfer to the following machine. As a result of not arranging the manipulator as a hand, a compact and high speed device was obtained. Thus, the servicing time of one work position, which includes the time of removing two packages (over 10 working movements) and the time of moving from the previous working position is only 16.5 seconds. The use of this automatic manipulator makes it possible to increase the productivity of labor and free service personnel from the heavy physical labor of handling packages with a total weight of about 8000 kg per man per shift. (see MEKHANIZATSIIA I AVTOMATIZATSIIA PROIZVODSTVA, 1982, No 3, pp 5-7).

Example 2. The manipulator for welding facings on parts weighing up to 160 tons, designed by the "Uralkhimmash" Production Association, has an extremely simplified arrangement in which the actuator has only two degrees of freedom, rotations of a face chuck on which the load is installed around vertical and horizontal axes. However, in spite of the simplicity of the manipulator arrangement, designers had to solve a number of complicated problems on reliably fixing a heavy weight on the face chuck, and providing for the working capacity of the kinematic pairs not only when acted upon by colossal loads, but also at high temperature, etc. Working jointly with a welding head moving along the vertical and horizontal, the manipulator made it possible not only to simplify the welding technology, but also to introduce efficient change in the design of heavy, high pressure vessels (see same journal, pp 8-10). Similar and other manipulator designs are being used in construction for making up to 300-ton spherical reservoirs.

Example 3. In various sectors of science and technology (for example, in instrument making, biological research, etc.), it may be necessary to manipulate superlight (weighing less than 1.5×10^{-3} kg) small size and even miniature (less than 10^{-2} meter) objects. In such cases, the hand of a man and manipulators designed to imitate the hand, are not capable of coping with such specific problems as eliminating mechanical damage to the manipulated objects with very low strength characteristics, as well as the necessity of high positioning accuracy of micrometer parts sometimes. Modern science and engineering also solved these problems, by producing manipulators new in design and principle of operation. There are automatic micromanipulators with a high-frequency vibration drive (see this journal, 1981, pp 11-13), as well as some based on contact and contactless force action in electric and magnetic fields, on an air cushion, etc.

Possibly, the indicated examples, do not reflect all directions of manipulator building. They just illustrate how creative overcoming of the traditional manipulator arrangement made it possible to expand by several orders of magnitude the range of load-lifting of these devices on the side of increasing, as well as decreasing the weight (and size) of the object being manipulated, and increase manipulation speed and precision of positioning. The development of the indicated devices was preceded by corresponding theoretical developments and by the solution of complicated specific problems. However, such basic theories as the theory of maneuverability and of the service angle, developed for the anthropomorphic arrangement, were not applied to these devices. Does it follow from this that the "manipulator" term is not applicable to the indicated devices? If the logic of some participants in the discussion is followed, then it is not applicable.

Actually, according to the standardized, i.e., legalized definition, a manipulator may be considered only a device whose actuator implements actions that imitate, i.e., reproduce repeating actions of the wrist of a human hand. Perhaps, this is the only standardized definition in which, instead of stating the essence of a device, a reference is given to the functions of a living object. Obviously, the definition of a manipulator born at the first stages of its development and that reflected the corresponding level of science and technology development, lagged the equipment development in its content.

Other and very graphical indicator of the fact that domestic interpretation of the manipulator was outdated is the definition of the term "manipulator" in the international classification of inventions introduced in 1980. This definition states the technical essence of the manipulator which consists of moving and orienting an intermediate product, article, material, etc., by remote control. In connection with the fact that GOST 21024-75 does not correspond to today, the international definition of the manipulator could be used as a basis for a new domestic definition (in this case, it would be necessary to take into account and eliminate possible imprecisions and roughnesses of the international definition that accompany translation from one language to another). Moreover, an important criterion of the manipulator that distinguishes it from other load-lifting devices is the fairly high accuracy of positioning. Therefore, taking into account all basic components of the international definition and the latter criterion, the manipulator could be defined as follows: "Manipulator is a remote controlled device for moving an intermediate product, article, material, etc., and setting it up with fairly accurate positioning in the space being serviced."

This definition would span all possible types of manipulators whose classification must be done in the new standard. For example, the classification by the control method may contain three manipulator types: manual control, automatic control or programed device with supervisor control. We will recall that in the existing GOST, the general definition of the manipulator contains distinguishing criteria of all these three manipulator types, which makes the definition not single-valued. Classification should also reflect other criteria: according to kinds of operations done, according to degree of specialization, by the type of the power drive, by the lifting power (for example, micromanipulators, manipulator of small, medium and high load-lifting power), by mobility, by the kinematic arrangement, etc. Such a clear classification of manipulators with unique definitions of each type would eliminate all excess discussions. For example, not all devices proposed by Comrade Bobrov will fall into the class of manipulators, since they implement only the movement of an intermediate product without orienting it with sufficient accuracy. Manipulators made in the anthropomorphic arrangement will be one of versions of modern manipulators, each of which has its advantages and disadvantages, its substantiation and theoretical analysis.

Thus, a onesided orientation of the existing terminology for manipulators of the anthropomorphous arrangement does not reflect all modern directions for the development of manipulator-building and is an obstacle on the road to producing and introducing manipulators of other arrangements. One practical step directed toward the implementation of the decree by the CPSU Central Committee "On measures for increasing production and the wide use of automatic manipulators in the sectors of the national economy in the light of instructions of the 25th party congress" may be the development of a new terminology and clear classification of manipulators. This step will facilitate the successful implementation of the posed problem, will expand sharply the area of using manipulators in nonmachinebuilding sectors of the national economy such as mining, metallurgical, light and food, agricultural, construction and transportation. It is possible that in the indicated sectors, manipulators, whose arrangement does not imitate a man's hand may be preferred.

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